

THE QUESTION OF THE PROPRIETY OF RESORT-
ING TO ARTHROTOMY FOR SUTURING
RECENT SIMPLE FRACTURES
OF THE PATELLA.

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IN THE course of a discussion at the Brooklyn Surgical Society in 1888, I expressed the following views: "that a surgeon who had become a master of the practice of anti-sepsis, as well as its principles, and who is able to control with certainty the conditions which surround his patient, would be justified in opening the knee-joint in a recent case of fracture of the patella, for suturing the fragments together, but that I doubted whether, excepting under such circumstances it would be justifiable."

I find, however, that in the most recent manual of surgery, which is just from the press, Roberts' Manual of Modern Surgery, the author declares, without qualification: "The treatment of fractured patella by wiring the fragments, and the management of cases with long fibrous union by resection and wiring are not justifiable. The disability resulting from imperfect connection of the fragments is not great enough to warrant the additional though slight risk to life assumed." Wyeth also, in his Text-book on Surgery, 1887, says, "the most unjustifiable method of treatment ever introduced in this fracture is that of opening into the joint and wiring the fragments together. Unjustifiable because, first of all, it is dangerous; secondly, because it is unnecessary." And W. T. Bull, in reporting the "Results of the Non-Operative Treatment of Fracture of the Patella," as obtained by him in twenty-two cases, takes occasion to condemn without exception wiring in recent

fractures, and challenges those surgeons who resort to the immediate suture to explain by what process of reasoning they can call it a justifiable procedure.

These all are authorities for whom I have the highest respect. The unqualified rejection which they unite in giving to the procedure in question has caused me to again carefully consider whether my own rather conservative position taken three years ago was not after all too radical.

One thing, however, I note in examining the grounds upon which this operation is condemned by the gentlemen named, viz., this, that their own experience with it has been either very limited, or very unfortunate, or both. Dr. Wyeth states that in 1881 he wired a fractured patella on the twentieth day after the accident, in the case of a woman, æt. 20 years; but that notwithstanding the strictest antiseptic precautions, including free drainage, destructive inflammation of the joint ensued with abscesses in the thigh, and the patient barely escaped with her life after amputation in the lower third of the thigh. He does not seem to have ventured upon the operation since that experience. Dr. Roberts has not recorded any case of the operation.

Dr. Bull reports but one case of arthrotomy, in cases of simple fracture of the patella, that one being for the repair of an old ununited fracture; in this case the operation was followed by suppurative arthritis and thigh abscesses and ultimate death.

The well known statistics of Brunner and of Dennis, however may be supposed to present material enough for forming a judgment, without the incurring of fresh and repeated hazards by new operators. Brunner, it will be remembered, in 1885 (*Deutsche Zeitsch. f. Chirg.* Bd. 23, s. 23; *Annals of Surgery*, 1886, vol. iii., p. 439) collected from all sources the particulars of 45 cases of recent fracture in which open arthrotomy with suture of the patella was done, and in 8 of these dangerous suppurative inflammation of the knee-joint followed, two terminating fatally, and two others saved by amputation. In 45 cases of old ununited fracture operated upon, reported by the same author, purulent inflammation ensued in 11, neces-

sitating amputation in one case, and resulting in death from pyæmia in three instances.

Dennis reported in the same year, 1886, from a search through the literature of the subject, details of 186 cases of arthrotomy and suture of the patella in both recent and old cases, 34 of which were complicated by suppuration, 4 required amputation, and 11 terminated in death. Nevertheless this same surgeon, Dennis, was able to report in April, 1880, (*N. Y. Med. Jour.*, 1890, June 14, p. 666,) that he himself had up to that date personally wired over 30 patellæ, and that in no case had life been jeopardised by the operation.

Lest this more favorable experience of Dennis should be supposed to be due to the specially favorable character of the cases or of the conditions in which these operations were done the equally favorable results obtained by other surgeons of New York during the same period is to be considered. Thus Dr. Stephen Smith reports 15 cases, Dr. Fluhrer 16 cases, and Dr. Chas. Phelps 44 cases, all without serious suppuration and without a death. Indeed most notable contributions to the subject have been made during the past year by Drs. Fluhrer and Phelps, especially by the latter in a paper read before the Bellevue Hospital Alumni Association, April 8, 1890. (*N. Y. Med. Jour.* May 31 and June 7, 1890). Lucas-Championniere (*Jour. de Med. et de Chirg. prat. Mars*, 1890) has also reported during this year a series of 14 cases, all likewise pursuing a favorable course without suppuration and securing firm bony union in the fractured patella.

The rational basis for immediate arthrotomy in recent fractures of the patella was established by Macewen in his observation first published in the *Lancet* in 1883, and further elaborated and reinforced in a contribution to the *Annals of Surgery* in 1887 (Vol. v., p. 177), in which he demonstrated that a frequent hindrance to bony union in fractures of the patella existed in the infolding and entanglement between the fragments of portions of the præpatellar aponeurotic structures. Mr. Macewen reported at that time 8 cases in which he had opened the knee-joint after fracture of the patella, in all of which he had found the conditions first mentioned, and in all of which, after clearing away the interposed structures and sut-

uring the fragments together, speedy, uncomplicated and firm union had taken place.

In connection with the present discussion, being desirous to know whether additional experience had in any way modified the views or practice of this surgeon, I addressed him a letter of inquiry on the subject, to which he replied as follows, under date of Sept. 1, 1890:

"I have had 13 opportunities of operating for transverse fracture of the patella. In each I have exposed the parts as soon after the reception of the injury as was permitted. In each there were intervening structures between the fragments which would have prevented osseous union, and in each, after these were raised and the bones brought together, firm, and, we believe, osseous union was obtained. Wounds healed aseptically and the patient was allowed up in six weeks, with slight splint. The movements afterwards in eleven were excellent, the limb being firm; several patients whose occupations were hazardous trusted their lives daily to the steadiness of their lower limbs. In a case of strong rheumatic habit, there was limited movement to about arc of 30° though wound healed aseptically, and in the thirteenth case there was a slight degree of stiffness. Both of these had sound limbs and could go up and down stairs easily. Under these circumstances I adhere to opinion formed in 1887."

Now up to the present date the experience of the six gentlemen just cited aggregates 132 cases, with uniformly favorable course of healing and with functional results unequalled by any other similar series of cases. Not all, but a very large proportion, of these were cases of recent fracture, having been operated on at periods varying from a few hours to 14 days after the injury.

It is of interest to know the final judgment as to the justifiability of this operation of these surgeons who have had the most experience. Macewen's has just been given. Stephen Smith says he has great confidence in the ability of the surgeon to operate without any serious results to the patient, but in view of the good results obtained by the ordinary method of treatment, he would be inclined to limit the operation to cases of refracture. (*N. Y. Med. Jour.*, June 14, 1890,

p. 667). Dennis is of opinion that the operation has the two advantages of (1) simplicity and (2) rapidity of cure, and that it does not require any special skill in its technique beyond that involved in the application of the general principles of antiseptic surgery. He considers that the knee-joint presents a very good field for antiseptic surgery. Championniere (*loc. citat*) says that this operation appears to him to constitute an ideal one. The remote results and the immediate effects find in it equally and at once their remedy. It is the most perfect type of treatment. It should be applied in every case except those in which some grave cachectic state, as diabetes or albuminuria, contraindicates any operation. Fluhrer believes it to be the duty of the surgeon, in case of recent simple transverse fracture of the patella (adequate skill being granted, and, subject to certain qualifications) to open the joint and suture the broken fragments, unless he can insure his patient a good result by the non-operative method, with freedom from crippling of the limb and the other disabilities potentially belonging to an imperfectly reconstructed knee-joint. Phelps says: "If the knee-joint can not be opened with safety, then aseptic surgery is a delusion and a failure. If we have faith in its theory and practice, it is cowardly to deprive our patients of all the advantages which may follow its acceptance. The demonstrated results of this operation are so far superior to those of other methods of treatment that its adoption becomes a matter of obligation, at least in these cases of recent fracture in which no contraindication is apparent."

It is apparent, as we view this whole question dispassionately, that the justifiability of arthrotomy and suture of the patella after fracture depends entirely upon the reliability and adequateness of the resources which surgeons possess to prevent septic infection of the wounds made. Now this cannot be a matter of theory, it is a matter of experience and practice; 44, 30, 16, 15, 14, 13 consecutive cases, in the hands of different surgeons, in which the knee-joint is widely opened and the constituents of the joint are freely handled for considerable periods of time, and all with immunity from septic infection, is sufficient demonstration that reliable and adequate precautions against harmful sepsis are possible to be obtained

by sufficient care and knowledge. And, *per contra*, the disastrous suppurations, entailing many times amputation or death, that have been reported from other observers, show the results that may follow imperfect antiseptic details, and warn against the indiscriminate practice of the operation.

There are two questions which must especially engage the attention of the surgeon when confronted by a fracture of the patella, viz.: (1) what amount of disability is probable if non-operative methods are employed, and (2) what risk is entailed if arthrotomy and suture is done? Both questions will be answered differently by different surgeons, and each answer may be equally conscientious and worthy to be respected. Thus we have, introduced into this question, and necessarily playing an important part in its settlement, the personal equation of the surgeon himself. I think that I have seen on the part of those who condemn arthrotomy and suturing a tendency to minify the disabilities resulting from fractures of the patella as ordinarily treated, and to be content with an imperfection of function that in reality is far from being an ideal result of treatment. Nor have I any unfavorable criticism to make of this tendency, for a somewhat rose-colored view of the result of his treatment may rightly be entertained by a surgeon when he is persuaded that it is the best result that he could obtain in the case. The fact that a patient is satisfied with the result is not in itself any evidence of its perfectness, for it is natural for a person who has met with this accident to fear great disability as its consequence; the prudent surgeon is not likely to promise too much as he undertakes the treatment, and so the final result, being better than the fears of the patient and the promises of the surgeon, is cheerfully accepted by the patient, who congratulates himself that he is as well off as he is. Good results from non-operative treatment demand prolonged treatment; Bull, whose results were exceptionally good, keeps on his splint for from three to four months, and does not expect to obtain his greatest functional recovery under one year. Wyeth advises a long splint for six months, and would apply a flexion-check apparatus thereafter to be worn for twelve months more. But however tedious and prolonged the treatment, however satisfactory or disappointing

the result, one great advantage attends it throughout, viz.: this, that the life of the patient has not been put to hazard in its course.

After all that has been said about the results possible from non-operative treatment it is not probable that any future writer will be able to express any more judicious and truthful opinion in this matter than was given by Frank Hamilton, at the close of his career, when he says: "The fact seems to be that more or less loss of freedom in the motions of the joint, and of strength and stability in the limb, remains in the majority of cases for a long period of time, and often during life; but that in a few exceptional cases, where the separation does not exceed one inch, the functions of the limb are completely restored within one or two years."—(*Treat. on Fract. and Dis.*, 1880, p. 513.)

As long as surgeons labored under the idea that failure of bony union after fracture of the patella was due to the inadequacy of their apparatus for keeping the fragments in coaptation, it was natural that surgical ingenuity should be taxed to its utmost to overcome the fancied forces that tended to draw the fragments away from each other. The first arthrotomies in cases of fractured patella were doubtless done by surgeons with the primary object of securing this coaptation by the more reliable means of the wire thread. Then first was demonstrated that the real cause of non-union was the almost constant interposition of fibrous tissue between the fragments. The original observations of Macewen have been corroborated by many other surgeons who have opened the knee-joint in recent fractures of the patella. Phelps, whose experience is the greatest, states that in every primary fracture he found the longitudinal aponeurotic fibers which cover the bone interposed to a greater or less extent between the fragments. Fluhrer makes practically the same statement, and Championiere, after describing the state of the interior of the knee-joint, as disclosed in his operations, says, "one understands that in removing all these clots, cleansing the synovial cavity, and freeing the fragments of the foreign matters which encrust them, the articulation is in a fashion reconstructed. One then realizes well why the hopes of those surgeons are vain who attempt

only to effect coaptation of the fragments. They can do nothing to remedy the state of the articulation itself; this coaptation even is not possible in the immense majority of cases."

Thus within the past few years an entirely new light has been shed on the pathology of fractures of the patella, and a new indication for treatment has come to dominate the scene. I will venture here to record my conviction that sufficient evidence has now accumulated to establish beyond question, as an almost constant occurrence, a sufficient interposition of fibrous tissue between the fragments of the patella to prevent bony union. With this demonstrated as a fact, a new question will hereafter have to be answered by surgeons when confronted by a broken patella, which will be something like this, Am I doing my whole duty by this patient if I make no attempt to remove this obstacle to union which I am morally certain is interposed between these fragments, and abandon him to at least a short ligamentous union, to probable considerable permanent disability and to possible grievous lameness for the remainder of his life?

As long as the disabilities recognized as following non-operative treatment of this injury were accepted as unavoidably inherent in the nature of the injury itself, the surgeon might properly content himself with traditional methods of treatment, but with the demonstration of a definite and positive cause for these disabilities, susceptible of removal, a powerful incentive is supplied to adopt those measures which will remove this cause unless it shall appear that these measures are likely to introduce serious dangers of their own.

The whole question hinges therefore on the risks inherent in arthrotomy and suture. What are they? The operation itself is simple in its nature and easy of execution; the dangers from shock and hæmorrhage are too insignificant to be taken into account. Septic infection, with its train of evils, is the one danger to be considered. Are the dangers from sepsis unavoidable, or avoidable? All surgeons are now agreed that they are avoidable by the adoption of certain precautions which have become well known and established as tenets of surgery. For the certain practice of these precautions careful training, much practice, and unremitting watchfulness is re-

quired. Certain accessories in the way of material and surroundings are likewise requisite.

None will gainsay that theoretically arthrotomy and suture can be done by surgeons so equipped by training, by practice, and with the needful accessories, without risk of serious detriment to the patient. As has been shown in the earlier part of my remarks, this has really been done in hundreds of cases. A logical conclusion from all that has been said is that it would be desirable that all patella-fractures should come under the care of surgeons so equipped.

Practically, however, the uncertainties of antiseptic work as usually done are known to be so great as to abundantly justify the apprehensions entertained by most surgeons as to the dangers attending the procedure in question and to prompt them both to refuse to employ it themselves, and to discourage its employment by surgeons in general.

This, however, in view of the unquestioned results of careful work on the part of a few, must be regarded after all as in some sort a shrinking from responsibilities which might fairly be undertaken by a thoroughly equipped surgeon.

If, as seems to have been demonstrated beyond a peradventure, arthrotomy and suture in the treatment of recent fracture of the patella is the most perfect method of treating that injury that our present knowledge of its pathology and of the possibilities of modern surgery presents to us, then it ought to be recognized as such, and the essentials for its successful practice should be clearly established and taught. Certainly there is no operative procedure which puts to a more severe test the perfectness of a surgeon's precautions against sepsis. There are doubtless as yet comparatively few by whom it ought to be done, but the number of those who can and will do it in the future will certainly greatly increase. I think therefore that the authors of recent surgical manuals, whom I have quoted, are open to criticism in having denounced this operation in such unqualified terms. For themselves they have a right to reject it; for others they have a right to advise against it, but to declare it baldly unjustifiable, is itself, in the light of our present knowledge and experience, hardly consistent with the progressive spirit which usually marks their teachings.

It is not the object of the present communication to discuss the technique of the operation; this has been recently very fully elaborated by other writers, especially by Phelps; nor to speak of the contraindications which special cases or conditions may present. The general state of the patient, pre-existing constitutional conditions, the existence of other injuries, the character of the local injury in cases of direct violence to the knee-joint, all these must be taken into consideration by the surgeon in forming an opinion as to what is proper to be done in an individual case. Nothing in what has been said is to be taken as suggesting in the least that all these considerations, which a surgeon weighs well in all his other work, are not to be equally weighed in connection with fractures of the patella.

During the last two and a half years I have myself treated all the cases of fracture of patella, six in number, that have come under my care, by arthrotomy and suture, with one exception.

All these cases have been treated in the Methodist Hospital. The case in which arthrotomy was not resorted to was that of a man, *æt.* 55 years, a tailor by occupation, who was sent to the hospital by his physician, Dr. Wm. Anderson, for the special object of having arthrotomy done. Upon examination, however, the tendency to separation was found not to be great; there was but little effusion into the joint; the damage to the capsule of the joint was evidently slight, so that there was reason to expect the best possible result from non-operative treatment. In addition his sedentary employment and his age made it a matter of less importance that absolute restoration of the full function of the joint should be secured. For these reasons in this case I contented myself with encircling the patella by a silk thread passed subcutaneously so that when the two ends were drawn upon and tied the fragments were held closely and securely together. The knee was then supported by a posterior plaster splint for eight weeks, at the end of which time all support was discarded. Firm union of the fragments resulted. A slight line of depression at the site of the fracture was perceptible when he was discharged, which was the only indication of the fibrous nature of the union. I

learn that the subsequent separation, after eighteen months, is very slight, not more than a quarter of an inch, while the function is good.

The cases of arthrotomy and suture are as follows, in the order of their occurrence:

CASE I.—Male, *æt.* 48 years. A house painter. Fell from a ladder and sustained a comminuted fracture of the right patella by direct violence presumably. Arthrotomy on the third day after the injury revealed a transverse fracture of the patella near its middle, lower fragment again broken into three pieces, shreds of fibrous tissue covering fractured surface of upper fragment. The joint was cleansed by irrigations with boro-salicylic solution, and the fragments after being properly cleared, were sutured together with silkworm-gut. Drainage from the joint cavity by rubber tubes for one week. Incision closed with catgut. Posterior plaster splint for five weeks. The case pursued an afebrile course, the operation wound healed by primary union. The patient was discharged at the end of six weeks with close and firm union in the patella. The movements of the knee were still somewhat restricted, but were steadily improving. I have not seen the patient since.

CASE II.—Female, *æt.* 20 years. A domestic. Patella fractured seven weeks before admission to hospital. No special treatment at the time. When admitted the fragments of the patella, which had been fractured transversely near its middle, were separated two and a half inches with no band of union. Marked disability. Arthrotomy. Broken surfaces of fragments covered by dense fibrous and cicatricial layer. These surfaces were refreshed; owing to contracture of quadriceps muscle it was impossible to bring the upper fragment down for coaptation to its fellow until after multiple partial transverse incisions of the rectus muscle had been made. The fragments were then sutured together with silkworm-gut. Rubber drain from joint for one week. Subsequent afebrile course of healing. Primary union in wounds. Firm and apparently bony union of fragments. Discharged at end of eight weeks, when motion at knee-joint was still quite restricted. When seen some months later, much improvement in range of motion had been obtained, and the union of the fragments remained secure.

CASE III.—Female, *æt.* 24 years. A domestic. Transverse fracture from indirect violence. Fragments widely separated with free tearing of the capsule. Arthrotomy on the third day. Fractured sur-

ace of upper fragment found to be covered in by a fibrous fold derived from the prepatellar aponeurosis; the joint filled with blood clot. Fractured surfaces cleaned; all shreddy torn material trimmed away; toilette of the joint made, and the fragments sutured together with silver wire. No drainage. Etage suture to capsule and operative wound. Posterior plaster splint. Subsequent afebrile course of healing. Primary union in wounds. Splint worn for five weeks. At end of six weeks began to walk about. Motions of joint considerably restricted when splint was first removed, but progressive improvement was manifested up to the time of her discharge from the hospital at the end of nine weeks. Firm and apparently osseous union in the patella was present.

CASE IV.—Male, æt. 40 years. An expressman. Transverse fracture of the patella from indirect violence; with separation of $\frac{3}{4}$ inch. Arthrotomy on the 4th day. Joint cavity filled with blood clot; shreds of fibrous tissue partially covered fractured surfaces; everything cleared away, with toilette of the joint; fragments sutured together with silver wire; a single rubber drain for five days. Posterior plaster splint. Afebrile course of healing. Primary union in wounds. At end of three weeks splint was removed, and firm apparently bony union of the fragments was present. Before the end of the fourth week patient was walking about the ward and during the fifth week went home able to freely flex and extend his leg.

CASE V.—The fifth case is a continuation of the history of Case IV. After returning home he engaged in light work without inconvenience, until one night while walking across a room hurriedly in the dark he struck the same knee violently against a chair, and again fractured his patella. For two weeks he delayed submitting to any treatment, having but little pain in the knee, and being annoyed chiefly by the loss of power to extend the limb. He finally again applied at the hospital for relief, the fragments having become separated to the extent of $1\frac{1}{4}$ inches. Arthrotomy was again done on the 18th day after the injury. The line of fracture through a little more than half its course was at the site of the primary fractures; it then deflected from it obliquely downward through the rest of its course. The fractured surfaces throughout presented the same appearance of recently broken bone after they were cleaned of the crust of mingled blood clot, plastic exudate and fibrous fringes with which they were covered. The fact of complete bony repair of the fracture was absolutely demonstrated. The original wire sutures were found attached to one of the fragments, one suture having been broken and the other having torn out, its loop being still in-

tact. The fragments were easily brought together, and after the toilette of the joint, were secured again by sutures of silver wire. A single rubber drain upon the joint for five days. Posterior plaster splint. Subsequent afebrile course of healing. Primary union of operative wounds. At end of five weeks the patella is firmly united and the patient is allowed to walk with a cane, and is advised to use a flexion-check posterior splint for perhaps three months.